# yang_seonhyeHW23

```
library(MASS)
library(car)
```

```
## Loading required package: carData
```

```
facebook_teach <- read.csv("facebook_teach.csv")
```

## Question 1a

```
with(facebook_teach, t.test(post_lrn[Trt == 0], post_lrn[Trt == 1]))
```

```
##
##  Welch Two Sample t-test
##
## data:  post_lrn[Trt == 0] and post_lrn[Trt == 1]
## t = -2.4643, df = 61.931, p-value = 0.01652
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -12.950101  -1.350082
## sample estimates:
## mean of x mean of y
##  34.26997  41.42006
```

We can see from these results that the difference in the sample mean scores is $-7.15016$, so the mean is greater for the facebook treated group. The p-value for the corresponding test of significance is 0.01652, so the result of our t-test is significant at a 95% level.

## Question 1b

```
fit1 <- lm(post_lrn ~  pre_lrn + Trt, data=facebook_teach)
fit2 <- lm(post_lrn ~ pre_lrn, data = facebook_teach)
summary(fit1)
```

```
##
## Call:
## lm(formula = post_lrn ~ pre_lrn + Trt, data = facebook_teach)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -28.8877  -7.6968   0.7031   8.0799  24.1965
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  25.3790     5.6959   4.456 3.37e-05 ***
## pre_lrn       0.3709     0.2237   1.658   0.1021
## Trt           6.8385     2.8502   2.399   0.0193 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 11.68 on 65 degrees of freedom
## Multiple R-squared:  0.1224, Adjusted R-squared:  0.09545
## F-statistic: 4.535 on 2 and 65 DF,  p-value: 0.01433
```

From this summary, we can see that the facebook connditioning (Group 1) has significant effect, as the coefficient is nearly 20 times greater.

```
anova(fit1, fit2)
```

```
## Analysis of Variance Table
##
## Model 1: post_lrn ~ pre_lrn + Trt
## Model 2: post_lrn ~ pre_lrn
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1     65 8868.0
## 2     66 9653.3 -1   -785.39 5.7567 0.0193 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Doing an ANOVA test, we can see that we obtain a p-value of 0.0193, indicating that there is a significant effect of conditioning between the two groups.

## Question 1c

```
fit3 <- lm(post_lrn ~  pre_lrn + Trt + pre_lrn:Trt, data = facebook_teach)
anova(fit3)
```

```
## Analysis of Variance Table
##
## Response: post_lrn
##             Df Sum Sq Mean Sq F value  Pr(>F)
## pre_lrn      1  452.0  451.99  3.4214 0.06898 .
## Trt          1  785.4  785.39  5.9451 0.01754 *
## pre_lrn:Trt  1  413.1  413.15  3.1274 0.08175 .
## Residuals   64 8454.8  132.11
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

From this ANOVA, we can see that the interaction between treatment and pre-trement achievement score in predicting post-treatment score has a p-value of 0.08175, indicating that there is no significant interaction in the 95% range.

## Question 2

```
powtwo <- 10
samples <- 2**powtwo
assignments <- matrix(0, samples, powtwo)
for(i in 1:samples) {
  assignments[i, ] = as.numeric(intToBits(i))[1:powtwo]
}
assignments[assignments == 0 ] <- -1
result <- apply(assignments, 1, function(x) t.test((shoes$A - shoes$B) * x)$statistic)
t.observed <- t.test(shoes$A - shoes$B)$statistic
```

```r
approx.pval <- mean(abs(result) >= abs(t.observed))
approx.pval
```

```
## [1] 0.01367188
```

We can see that from the previous computation, the exact randomization p-value for the paired t-statistic is 0.01367